

REMARKS/ARGUMENTS

In this First 114 Amend, Applicants amend the specification and replace the Abstract of the Disclosure, both in order to improve clarity. Applicants also cancel, without prejudice or disclaimer, claims 1, 2, 6-10, and 12-19. Additionally, Applicants add new claims 22-41. No new matter is introduced.

Prior to entry of the First 114 Amend, claims 1, 2, 6-10, and 12-19 were pending in the application. After entry of the First 114 Amend, claims 22-41 are pending in the application.

In the Second FOA, the Examiner rejected claims 1 and 6 under 35 U.S.C. § 112, ¶ 1; rejected claims 1, 2, 6-10, and 15-17 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 4,030,569 to Berkovitz (“Berkovitz”) in view of U.S. Patent No. 5,429,211 to Aulanko et al. (“Aulanko I”), U.S. Patent No. 5,975,826 to Scholder (“Scholder”), and U.S. Patent No. 4,624,097 to Wilcox (“Wilcox”); rejected claims 12-14 under 35 U.S.C. § 103(a) as being unpatentable over Berkovitz in view of Aulanko I, Scholder, and Wilcox, and further in view of World Intellectual Property Organization International Publication No. WO 99/43595 to Hollowell et al. (“Hollowell”); and rejected claims 18 and 19 under 35 U.S.C. § 103(a) as being unpatentable over Berkovitz in view of Aulanko I, Scholder, and Wilcox, and further in view of U.S. Patent No. 5,665,944 to Aulanko et al. (“Aulanko II”).

Incorporation of Previous Arguments by Reference

In addition to the arguments presented below, Applicants specifically incorporate by reference the arguments made in the Amendment Under 37 C.F.R. § 1.111 ("First Amend") filed on January 3, 2006; the Amendment After Final Under 37 C.F.R. § 1.116 ("First AAF") filed on November 1, 2006; the Amendment Under 37 C.F.R. § 1.111 ("Second Amend") filed on July 16, 2007; the Amendment Under 37 C.F.R. § 1.111 ("Third Amend") filed on April 22, 2008; and the Amendment Under 37 C.F.R. § 1.111 ("Fourth Amend") filed on November 28, 2008.

Status of Drawings

Applicants note that no Form PTOL-326s in any Office Action for the present application appears to definitively indicate that the drawings are accepted.

Applicants request that the Examiner indicate the complete and correct status of the drawings—including the originally filed drawings; the Transmittal of Substitute Formal Drawings filed on January 12, 2004; and the drawings filed in the First Amend and the First AAF—in the next paper mailed by the U.S. Patent and Trademark Office ("USPTO").

Claims 1, 2, 6-10, and 12-19

As discussed above, Applicants cancel, without prejudice or disclaimer, claims 1, 2, 6-10, and 12-19. Applicants submit that this cancellation obviates

the Second FOA's objection and rejections and request that the associated objection and rejections be withdrawn.

New Independent Claims 22, 36, and 37

Applicants submit that new independent claims 22, 36, and 37 are patentable under 35 U.S.C. § 103(a) over the cited art, at least because no proper combination of Aulanko I, Aulanko II, Berkovitz, Hollowell, Scholder, and/or Wilcox, for example, appears to teach or suggest all of the recitations of claims 22, 36, and 37, including: “[a] gearless cable-operated elevator without machine room . . . comprising”, “a cage”, “a counterweight”, “a plurality of carrier cables”, “cage guide rails”, “counterweight guide rails”, “a drive sheave”, “a counter sheave”, “wherein the cage and the counterweight are supported by the plurality of carrier cables”, “wherein the cage is guided by the cage guide rails”, “wherein the counterweight is guided by the counterweight guide rails”, “wherein the drive sheave and the counter sheave are spaced apart from each other”, “wherein the plurality of carrier cables wraps at least partially around the drive sheave a first time, at least partially around the counter sheave a first time, at least partially around the drive sheave a second time, and at least partially around the counter sheave a second time”, “wherein the drive sheave is configured to act on the plurality of carrier cables in order to move the cage and the counterweight”, “wherein each cable of the plurality of carrier cables has a nominal diameter greater than 5 mm and less than 7 mm”, “wherein the drive sheave includes semicircular grooves”, “wherein the semicircular grooves

include undercut portions", "wherein the undercut portions have a width greater than 1 mm and less than 3 mm", "wherein the drive sheave is configured so that the plurality of carrier cables runs in the semicircular grooves", and "wherein a ratio of a diameter of the drive sheave to a nominal diameter of each cable of the plurality of carrier cables is greater than or equal to 30:1 and less than or equal to 40:1" (claim 22); "[a] gearless cable-operated elevator without machine room . . . comprising", "a cage", "a counterweight", "a plurality of carrier cables", "cage guide rails", "counterweight guide rails", "a drive sheave", "a counter sheave", "wherein the cage and the counterweight are supported by the plurality of carrier cables", "wherein the cage is guided by the cage guide rails", "wherein the counterweight is guided by the counterweight guide rails", "wherein the drive sheave and the counter sheave are spaced apart from each other", "wherein the plurality of carrier cables wraps at least partially around the drive sheave a first time, at least partially around the counter sheave a first time, at least partially around the drive sheave a second time, and at least partially around the counter sheave a second time", "wherein the drive sheave is configured to act on the plurality of carrier cables in order to move the cage and the counterweight", "wherein each cable of the plurality of carrier cables has a nominal diameter greater than 5 mm and less than 7 mm", "wherein the drive sheave includes semicircular grooves", "wherein the semicircular grooves include undercut portions", "wherein the undercut portions have a width greater than 1 mm and less than 3 mm", "wherein the

drive sheave is configured so that the plurality of carrier cables runs in the semicircular grooves", and "wherein a ratio of a diameter of the drive sheave to a nominal diameter of each cable of the plurality of carrier cables is substantially 30:1" (claim 36); or "[a] gearless cable-operated elevator without machine room . . . comprising", "a cage", "a counterweight", "a plurality of carrier cables", "cage guide rails", "counterweight guide rails", "a drive sheave", "a counter sheave", "wherein the cage and the counterweight are supported by the plurality of carrier cables", "wherein the cage is guided by the cage guide rails", "wherein the counterweight is guided by the counterweight guide rails", "wherein the drive sheave and the counter sheave are spaced apart from each other", "wherein the plurality of carrier cables wraps at least partially around the drive sheave a first time, at least partially around the counter sheave a first time, at least partially around the drive sheave a second time, and at least partially around the counter sheave a second time", "wherein the drive sheave is configured to act on the plurality of carrier cables in order to move the cage and the counterweight", "wherein each cable of the plurality of carrier cables has a nominal diameter greater than 5 mm and less than 7 mm", and "wherein a ratio of a diameter of the drive sheave to a nominal diameter of each cable of the plurality of carrier cables is greater than or equal to 30:1 and less than or equal to 40:1" (claim 37).

First, Applicants submit that Wilcox fails to disclose either "wherein a ratio of a diameter of the drive sheave to a nominal diameter of each cable of

the plurality of carrier cables is greater than or equal to 30:1 and less than or equal to 40:1" (claims 22 and 37) or "wherein a ratio of a diameter of the drive sheave to a nominal diameter of each cable of the plurality of carrier cables is substantially 30:1" (claim 36), because a person having ordinary skill in the art ("PHOSITA") would understand that the term "about", when used together with a numerical quantity, normally may be interpreted to encompass a range of values within the scientific convention of rounding, as discussed, for example, in § 4.03[J], on page 4-88.2, of Patent Claim Construction by Robert C. Kahrl (© 2008).

Thus, for example, Applicants submit that a PHOSITA would understand the recitation "normal sheave/rope ratios (i.e. about 24)" (Wilcox, c. 3/ll. 24-25) to encompass sheave/rope ratios greater than or equal to 23.5:1 and less than or equal to 24.4:1. As a result, Applicants submit that the broadest reasonable interpretation of "about 24" fails to encompass at least the following recitations: "30:1", "substantially 30:1", "substantially 34:1", "40:1", "less than or equal to 40:1", and "greater than or equal to 30:1 and less than or equal to 40:1"—contrary to the allegation at p. 4, § 11, and p. 6, § 19, of the Second FOA.

Second, Applicants submit that the Wilcox's ratio of "about 24" would result in a drive sheave with a diameter smaller than that claimed for a given nominal diameter of the set of carrier cables. As a result, Applicants submit that the purported motivation to "decrease the diameter of the drive sheave"

(Second FOA, p. 5, § 14, and p. 7, § 23) (emphasis added) utterly fails because for a given nominal diameter of the set of carrier cables, the claimed drive sheave has a larger diameter than that discussed in Wilcox.

Third, the Second FOA's statement that "it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art" (id., p. 4, § 13, and p. 5, § 14) demonstrates a misplaced reliance on In re Aller¹ (copy attached), which Applicants submit is not even logically relevant to the Examiner's argument.

In In re Aller, a single prior art reference disclosed an identical chemical process, with the exception of the temperature and sulfuric acid concentration involved. The alleged invention involved lowering the temperature and raising the sulfuric acid concentration. In stark contrast, the Second FOA is attempting to combine portions of two references (Aulanko I and Berkovitz) from U.S. Classification 187/XXX, with portions of a third reference (Wilcox) from U.S. Classification 57/232 and portions of a fourth reference (Scholder) from U.S. Classification 414/444, where the Examiner appears unable to find any reference in at least U.S. Classification 187/XXX that even arguably discloses either "wherein each cable of the plurality of carrier cables has a nominal diameter greater than 5 mm and less than 7 mm" (independent claims 22, 36, and 37), "wherein a ratio of a diameter of the drive sheave to a

¹ In re Aller, 105 USPQ 233 (C.C.P.A. 1955).

nominal diameter of each cable of the plurality of carrier cables is greater than or equal to 30:1 and less than or equal to 40:1" (claims 22 and 37), or "wherein a ratio of a diameter of the drive sheave to a nominal diameter of each cable of the plurality of carrier cables is substantially 30:1" (claim 36). Thus, Applicants submit that In re Aller is not logically relevant to the Examiner's argument at least because this is not a situation in which "the general conditions of a claim are disclosed in the prior art". As a result, the Second FOA's reliance on In re Aller is misplaced.

Fourth, the Second FOA alleges that:

[I]t has been held that discovering an optimum value of a result effective variable involves only routine skill in the art.

Id., p. 7 § 23, citing In re Boesch² (copy attached). Applicants disagree, noting that this case actually says:

[D]iscovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art.

Id. at 219 (emphasis added), citing In re Antonie³ (copy attached). Because claims 22-41 are directed to apparatuses not processes, Applicants submit that In re Boesch is not directly applicable to the claims of the present application and, as a result, the Second FOA's argument fails regarding the alleged obviousness of the ratio of the drive sheave diameter to the nominal diameter of the carrier cables.

² In re Boesch, 205 USPQ 215 (CCPA 1980).

³ In re Antonie, 195 USPQ 6 (CCPA 1977).

Fifth, the citation in In re Boesch to In re Antonie also is instructive because the second case further states that the parameter to be optimized must be recognized in the prior art as a result-effective variable. Id. at 8-9. The Second FOA offers no evidence that the prior art recognized the ratio of the drive sheave diameter to the nominal diameter of the carrier cables as a result-effective variable and, as a result, the Second FOA's argument fails regarding the alleged obviousness of the ratio of the drive sheave diameter to the nominal diameter of the carrier cables.

Sixth, both In re Boesch and In re Antonie are discussed in MPEP 2144.05.II.B, which states in relevant part, citing In re Antonie:

A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation.

As discussed above, the Second FOA offers no evidence that the prior art recognized the ratio of the drive sheave diameter to the nominal diameter of the carrier cables as a result-effective variable and, as a result, the Second FOA's argument fails regarding the alleged obviousness of the ratio of the drive sheave diameter to the nominal diameter of the carrier cables.

For at least these reasons, Applicants submit that independent claims 22, 36, and 37 are patentable under 35 U.S.C. § 103(a) over any proper combination of Aulanko I, Aulanko II, Berkovitz, Hollowell, Scholder, and/or Wilcox.

New Dependent Claims 23-35

Applicants submit that new dependent claims 23-35 are patentable under 35 U.S.C. § 103(a) over any proper combination of Aulanko I, Aulanko II, Berkovitz, Hollowell, Scholder, and/or Wilcox, for at least the same reasons as claim 22, from which claims 23-35 directly or indirectly depend.

New Dependent Claims 38-41

Applicants submit that new dependent claims 38-41 are patentable under 35 U.S.C. § 103(a) over any proper combination of Aulanko I, Aulanko II, Berkovitz, Hollowell, Scholder, and/or Wilcox, for at least the same reasons as claim 37, from which claims 38-41 directly or indirectly depend.

Request for Reconsideration and Allowance

Accordingly, in view of the above amendments and remarks, reconsideration of the rejections and allowance of each of claims 22-41 in connection with the present application is earnestly solicited.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

If necessary, the Director of the USPTO is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 08-0750 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; in particular, extension of time fees.

Respectfully submitted,

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XQ67. You don't know whether that ever resulted in a registration or what happened to it? A. No, I don't know.

XQ68. Was its prosecution taken over by the attorneys for Nettie Rosenstein? A. I don't know whether they prosecuted it under our name. I doubt that very much.

XQ69. Did you ever make an abandonment of the application? A. I don't know. I would have to consult the patent attorney who handled the matter at that time.

XQ70. Who was that? A. Murray & Parker.

XQ71. Of New York? A. Yes. The firm now goes under the name of Parker & Graham.

XQ72. So that your company claimed to be the owner of the trade mark "Odalisque" continuously from 1936, when you adopted it, up until February 7 of 1946, when you executed these assignment documents, Exhibits 6-A, 6-B, and 6-C; is that right? A. Yes.

XQ73. And you claimed to be the owner of the trade mark and of all rights in it all during the year 1946; is that correct? A. That is correct.

It is perfectly clear that Rubin did not sell applicant its *business or any interest therein*. The following statement from opposer's brief is accurate according to the record (References to pages of the record are deleted as indicated by asterisks):

Applicant's witnesses admitted that there was no going business which was transferred or which could have been transferred to applicant at the time of the alleged assignment * *. The alleged assignor had not sold any perfume for five years prior to the assignment * *. There was no transfer of merchandise, materials, inventory, labels or anything of a material nature * *. Nothing was transferred in addition to the piece of paper purporting to be an assignment * *.

The Examiner-in-Chief, therefore, correctly stated the law in that part of his decision reading, 98 USPQ at 31:

It is clear from the testimony of the witness Rubin that at the time the assignment was executed Rubicon, Inc. was not engaged in the perfume business and had not been so engaged [5] since 1941 or 1942. The nonuse of the mark by Rubicon, Inc., during the war period may not have constituted an abandonment of the mark, nevertheless a mark may not be legally [6] transferred to another unless accompanied by the transfer of some business with which the mark is shown to have been used. Kelly Liquor Co.

v. National Brokerage Co., Inc., 26 C.C.P.A. [Patents] 1110, 102 F.2d 857, 41 USPQ 311. (Italics supplied by us.)

From the statement made by counsel for opposer, quoted *supra*, which apparently was accepted by counsel for applicant as evidentiary in character, it is clear that opposer objected to the use of the mark by applicant as early as December 5, 1945, and we find nothing in the record which, in our opinion, would justify a finding of laches and acquiescence on the part of opposer amounting to an estoppel of opposer's right to oppose.

The decision of the Examiner-in-Chief sustaining that of the Examiner of Interferences is, therefore, *affirmed*.

42 C.C.P.A. (Patents) 824

Court of Customs and Patent Appeals

In re ALLER, LACEY, AND HALL

Appl. No. 6079 Decided Mar. 22, 1955

PATENTS

1. Patentability—Change—In general (\$ 51.251)

Patentability—Change — Proportions (\$ 51.259)

Normally, change in temperature, concentration, or both, is not patentable modification; however, such changes may impart patentability to process if ranges claimed produce new and unexpected result which is different in kind and not merely in degree from results of prior art; such ranges are termed "critical" ranges, and applicant has burden of proving such criticality; even though applicant's modification results in great improvement and utility over prior art, it may still not be patentable if modification was within capabilities of one skilled in art; more particularly, where general conditions of claim are disclosed in prior art, it is not inventive to discover optimum or workable ranges by routine experimentation.

2. Patentability—Evidence of—Commercial success—Doubtful cases (\$ 51-4557)

Commercial success or improved results are important only when question of invention is in doubt; where there is no doubt that improvement resulted

from routine efforts of artisan, commercial utility is unimportant.

3. Patentability—Invention—In general (§ 51.501)

To support patent, it must be shown that claimed process was not obvious to one skilled in art, who had prior art article before him.

4. Patentability—Anticipation—In general (§ 51.201)

References are valid for what they convey, explicitly or implicitly, to one skilled in art; that experimentation may not have appeared promising is of no importance; reference may be valid even though it states that its disclosure is not practical.

Particular patents—Organic Peroxides

Aller, Lacey, and Hall, *Decomposition of Organic Peroxides*, claims 1 to 10, 15, and 16 of application refused.

Appeal from Board of Appeals of the Patent Office.

Application for patent of Basil Vivian Aller, Richard Norman Lacey, and Reginald Harold Hall, Serial No. 45,326, filed Aug. 20 1948; Patent Office Division 31. From decision rejecting claims 1 to 10, 15, and 16, applicants appeal. Affirmed.

CLINTON F. MILLER, Wilmington, Del., for appellants.
E. L. REYNOLDS (J. SCHIMMEL of counsel) for Commissioner of Patents.

Before GARRETT, Chief Judge, and O'CONNELL, JOHNSON, WORLEY and COLE, Associate Judges.

COLE, Judge.

This is an appeal from a decision of the Board of Appeals of the United States Patent Office, affirming the rejection by the Primary Examiner of appellants' application for a patent, Serial No. 45,326, filed August 20, 1948, for "Decomposition of Organic Peroxides." Of the original sixteen claims, claims 11-14 have been withdrawn, and no claims have been allowed, all having been denied as unpatentable over a reference specifically acknowledged in the application as prior art, as hereinafter discussed.

The rejection was made upon an article appearing in the Journal of the German Chemical Society in 1944, by Heinrich Hock and Shon Lang, entitled, "Autoxidation of hydrocarbons, Report no. 9: Concerning peroxides of benzene derivatives." The reference is cited as follows:

Hock et al. Ber. Deut. Chem. Ges., 77B, pages 257 to 262, 1944.

The application is for a process for the production of phenol (carbolic acid), a chemical with wide uses as an anti-septic and preservative, and as an ingredient in the production of synthetic resins, explosives, drugs, photographic developers, and dyes. Ketones (particularly acetone) are produced as by-products of the process.

Basically, the process sought to be patented involves the treatment of isopropyl benzene hydroperoxide (or similar organic peroxides) with sulphuric acid, wherein the hydroperoxide is decomposed into phenol and acetone (or other ketones). So far as pertinent to this appeal, it is not necessary to inquire into the particular chemical reactions occurring in the process, nor is it necessary to discuss the method by which isopropyl benzene hydroperoxide is formed.

The process of appellants is identical with that of the prior art, except that appellants' claims specify lower temperatures and higher sulphuric acid concentrations than are shown in the reference. (Some of the claims also specify the use of solvents, but these are better discussed separately.) The main question involved in this appeal is whether the changes in temperature and in acid concentration amount to invention, or whether such changes would have been obvious to one skilled in the art.

Claim 8 was quoted by the Board of Appeals as illustrative, and reads as follows:

8. Process for decomposing isopropyl benzene hydroperoxide and the production thereby of phenol and acetone which comprises bringing said peroxides into intimate contact with aqueous sulphuric acid of a concentration between 25 and 70% at temperatures between 40° and 80°.

The reference article shows essentially the same process as that recited in the claims, except that the only experiment discussed in the article was conducted at a temperature of 100° C. and with a 10% sulphuric acid solution.¹

¹Without subscribing to the accuracy of the translation, we set forth at this point the experiment as described in the reference in the following language:

Acid cleavage: 1.2 g. isopropylbenzol peroxide were heated with 15 ccm. 10% sulfuric acid on the reflux condenser (temperature in the tube 100°, in the condenser 60°). The condenser outlet was connected with a U-tube which contained about 2 ccm. water and was cooled with ice. The reaction mixture was cooled for 1½ hours, 2 g. sodium hydroxide added and then filtered through a wet filter in doing which oily drops (presumably dimethyl-phenyl-

The Primary Examiner held that the conditions of the claims resulted simply from experimentally varying the different factors of the process to determine the optimum reaction condition and was within the skill of the art; that there was no evidence to indicate that the reported increase in yields was a difference in kind and not of degree; that no actual commercial success had been shown; that even if commercial success had been shown, it would be insufficient of itself to show invention; and that quickened reaction times were not pertinent to show invention.

The Board of Appeals, in affirming the examiner, stated that experimentation to find the optimum conditions of temperatures and acid concentration was "no more than the application of the expected skill of the chemical engineer * * *." The board stated that the record did not show any significant improvement in the efficiency of the process resulting from a difference in temperature, and that the essential question was whether an increase of concentration of acid which resulted in an increase in yield was a difference of degree only, or whether it was a "difference of such magnitude as to justify the allowance of the claims." The board held that the record failed to support a holding that there was patentable invention. An affidavit submitted by appellants after the examiner's rejection in an attempt to prove that the claimed process was "commercially attractive" while that of the reference was not, was accepted by the board only as further argumentation, and not as evidence.

[1] Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art. In re Dreyfus, 22 C.C.P.A. (Patents) 830, 73 F.2d 931, 24 USPQ 52; In re Waite et al., 35 C.C.P.A. (Patents) 1117, 168 F.2d 104, 77 USPQ 586. Such

carbinol were left behind). The filtrate was shaken with 1.5 g. of benzoyl chloride and the separated phenyl benzoate recrystallized from alcohol. Melting point 68-69°. Yield 1.15 g. (75% of the theoretical). The mixture melting point with phenyl benzoate showed no reduction.

The aqueous solution in the U. tube showed with sodium nitroprussiate on the addition of ammonia and some solid ammonium chloride a permanganate red coloring (acetone).

ranges are termed "critical" ranges, and the applicant has the burden of proving such criticality. In re Swenson et al., 30 C.C.P.A. (Patents) 809, 132 F.2d 1020, 56 USPQ 372; In re Scherl, 33 C.C.P.A. (Patents) 1193, 156 F.2d 72, 70 USPQ 204. However, even though applicant's modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within the capabilities of one skilled in the art. In re Sola, 22 C.C.P.A. (Patents) 1313, 77 F.2d 627, 25 USPQ 433; In re Normann et al., 32 C.C.P.A. (Patents) 1248, 150 F.2d 708, 66 USPQ 308; In re Irmscher, 32 C.C.P.A. (Patents) 1259, 150 F.2d 705, 66 USPQ 314. More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. In re Swain et al., 33 C.C.P.A. (Patents) 1250, 156 F.2d 239, 70 USPQ 412; Minnesota Mining and Mfg. Co. v. Coe, 69 App. D.C. 217, 99 F.2d 986, 38 USPQ 213; Allen et al. v. Coe, 77 App. D. C. 324, 135 F.2d 11, 57 USPQ 136.

Bearing in mind the foregoing, we examine the arguments of appellants to determine whether they have demonstrated patentability over the experiment of Hock and Lang.

Appellants specify three improved results from the conditions of the process sought to be patented; increased yields of phenol; increased yields of acetone; and shortened reaction times. These results, it is claimed, combine to make appellants' process commercially attractive while that of the reference would be commercially unattractive.

The yield of phenol reported by the reference article was 75% of theoretical, whereas the examples of appellants' specification show phenol yields of 83.7 to 100%. The reference did not state what acetone yield Hock and Lang obtained, although it did indicate that acetone was produced. Appellants' specification states that in following the conditions of the reference they obtained an acetone yield of about 60%. By their own method, appellants report acetone yields of from 71 to 88%, the yield, however, not being reported for two examples. The Hock and Lang reference experiment was completed in an hour and a half. Appellants' examples show comparable reaction times ranging from a total time of 20 minutes to three hours.

In analyzing these improved results, one is not struck by any difference in kind attributable to appellants' process—logically the improvements could flow equally well from changes in degree resulting from routine variation in temperature or acid concentration. At the least efficient conditions reported by ap-

pellants, the improvement is but a few percentage points different from the results reported by the reference. At the most efficient conditions, the improvement is still within the range of variation one might expect to result from changes in reaction conditions. There is no temperature range or acid concentration range that can really be termed "critical." As far as is shown, temperatures between 80° and 100° C., and acid concentrations between 10% and 25%, could result in increasingly greater efficiency, somewhat more than Hock and Lang, somewhat less than appellants. Appellants have not shown anything "critical" about their process, unless lower temperatures and higher acidity generally are critical.

Even the affidavit of Sheffield does little more than compare the results reported by the reference and those reported by appellants, and give an opinion as to how much less costly one would be than the other. The affidavit clearly does not show commercial success. It only presents affiant's opinion that when the price of phenol is 19 cents a pound, appellants' production would be economically profitable, while that of the reference would not. His statement is equally compatible with the theory that the improvement is a difference of degree, as it is with the theory that it is a difference of kind.

[2] However, for purposes of discussion, it may be assumed that appellants have shown an improvement over the reference, and that commercial success has been adequately demonstrated. Commercial success or improved results, however, are important only when the question of invention is in doubt. When there is no doubt that improvement resulted from routine efforts of the artisan, then commercial utility is unimportant. To

[3] support a patent, it must be shown that the claimed process was not obvious to one skilled in the art, who had before him the Hock and Lang article.

Appellants contend that the claimed conditions would not be discovered by one skilled in the art, because shortened reaction times would not be expected with lower temperatures; increased resinification (and hence lower yields) of phenol and acetone would be expected with stronger acids; and greater danger of explosion would be expected at lower temperatures.

In support of the first argument, appellants state that theoretically reaction time is doubled or trebled for each 10°C. drop in temperature, while it is only shortened proportionately with an increase in the concentration of a reactant. Hence, it is argued that a skilled chemist would expect the reaction time

to be inordinately lengthened by a decrease in temperature, despite an increase in the concentration of the sulphuric acid. Assuming appellants' propositions to be applicable, it still does not follow that a skilled chemist would not try to shorten the reaction time by lowering the temperature and increasing the acid concentration. Thus, applying appellants' reasoning, at 80°C. and 70% acid concentration (which is within the limits of the claims) it would be expected that the reaction rate would be slowed at least four times by the temperature reduction—but that it would be accelerated *seven* times by the increase in acid concentration.

There is a dispute between counsel as to the validity of appellants' second assertion, that resinification should be expected with higher acid concentrations. The Solicitor for the Patent Office cited authority to show that such resinification occurs only under extreme conditions of pressure and temperature. Appellants in a reply brief give further citation to the same authority to show the conditions were not as drastic as indicated by the solicitor. However, even taking at full value all the statements of appellants, it still appears that the reaction is a slow one, taking as long as twelve hours or more for completion, and that it is affected by temperature. There is no evidence to show that a chemist should necessarily expect that an increase in acid strength would be impracticable. As far as the evidence shows, the increased resinification due to stronger acidity might be negligible in its proportions, or it might be extensive. Experimentation would be indicated to determine the exact effect.

The third argument of appellants in this regard is that a chemist would assume that the reaction would be more likely to be explosive at a lower temperature. It is stated in appellants' brief:

A final consideration and one which is most important is the safety of the process. If the reaction time of the Hock et al. process were to be lengthened as by lowering the temperature, as the hydroperoxide is added to the acid the concentration of hydroperoxide would increase due to the slowness of the decomposition process. *There would then be great danger of the reaction becoming exothermic and causing a violent explosion.* Within the limits of the appealed claims, however, the reaction may be safely carried out. [Italics quoted.]

That a reaction would be more explosive at a lower temperature goes against all common experience, and is apparently based on a gratuitous assumption that

the hydroperoxide will be added to the reaction solution faster than it is being decomposed. Whether or not the general proposition is correct, there is insufficient proof of it in this record for us to reverse the concurring decisions of the tribunals of the Patent Office.

Upon reviewing all of the evidence in the case, it is evident that the contentions of appellants cannot be upheld. Hock and Lang disclosed generally the process of decomposition of isopropyl benzene hydroperoxide by sulphuric acid, with the production of phenol and acetone. They described one experiment and its results, indicating in no way that this was the maximum yield obtainable. Any chemist reading the article could logically assume that higher yields might be obtainable, and by experimentally varying the conditions of temperature and acidity could find the most productive conditions. If it could be held that the skilled chemist would never think to reduce the temperature or increase the acid concentration, then it might be held that invention resides in so doing. However, appellants have not demonstrated such fact. The skilled chemist who chose to experiment with the reference process would undoubtedly try the conditions defined by the claims, although he might be surprised at the extent of improvement obtained. No invention is involved in discovering optimum ranges of a process by routine experimentation. In re Swain et al., *supra*.

[4] Appellants suggest that the decision to experiment with the process in the first place involves invention, apparently on the theory that the process as disclosed by Hock and Lang appeared so impractical that no skilled chemist would have experimented with it. References have always been valid for what they would convey, explicitly or implicitly, to one skilled in the art. That experimentation may not have appeared promising is of no importance. It has been held that a reference may be valid even though it states in so many words that its disclosure is not practical. In re McKee et al., 25 C.C.P.A. (Patents) 1116, 96 F.2d 504, 37 USPQ 613; In re Krukovsky et al., 38 C.C.P.A. (Patents) 731, 184 F.2d 333, 87 USPQ 110.

The Board of Appeals, in concluding its opinion, stated as follows:

* * * any one in possession of the information presented by Hock et al. would naturally experiment to discover optimum conditions of temperature and concentration of acid for commercial exploitation of the process. Such experimentation is no more than the application of the expected skill of the chemical engineer and failure to

perform such experiments would, in our opinion, show a want of the expected skill of the engineer. * * *

That we are in complete agreement with the board's reasoning is clear from the foregoing discussion.

Some of the appealed claims, as noted above, specify the use of certain solvents in the process, in addition to the temperature and acid concentration limitations. The Primary Examiner stated that the reference showed the use of solvents, and stated that the choice of a particular solvent was within the skill of the art. The Board of Appeals affirmed this ground of rejection. Although appellants argue that this feature imparts patentability to the claims, no arguments are advanced sufficient to discredit the examiner's ruling in this respect.

It being apparent that the claimed process is merely different in degree and not in kind from the reference process, and that the criticality of the claimed ranges has not been shown, the decision of the Board of Appeals is affirmed.

42 C.C.P.A. (Patents) 817

Court of Customs and Patent Appeals

In re ROSE

Appl. No. 6080 Decided Mar. 22, 1955

PATENTS

1. Patentability — Change — Size or strength (§ 51.261)

Size of article ordinarily is not matter of invention.

2. Court of Customs and Patent Appeals — Issues determined — Ex parte patent cases (§ 28.203)

Since one rejection must be sustained, it is unnecessary for court to discuss another rejection.

3. Patentability — In general (§ 51.01)

Feature upon which applicant predicates patentability must not only be disclosed in specification but also brought out or recited in claims.

4. Patentability — In general (§ 51.01)

Patentability — Invention — In general (§ 51.501)

Novel concept, *per se*, is not conclusive of invention; everything which is novel is not patentable, because, in addi-

Corp. v. Stafford Knitting Mills, 490 F.2d 1092, 1094, 180 USPQ 545, 546 (2d Cir. 1974), and decisions cited therein, including Scarves by Vera v. United Merchants and Manufacturers, 173 F.Supp. 625, 627, 121 USPQ 578, 579-80 (S.D.N.Y. 1959). Although we have never ruled as a matter of law on the issue, it seems to me that if color is to be taken into consideration for infringement purposes, it must inevitably be considered as an element of the copyrighted subject matter.

In short, what Novelty copyrighted was its plaid design in a brown, beige and white color combination. In this well-plowed field of Argyle and bias plaids, it obviously did not gain protection against the manufacture of all similar textile plaids, even though some might be produced by persons who had access to its copyrighted design. In my view it gained copyright protection for the overall effect or impression created by the particular combination of lines, space, juxtaposition, shading and color scheme. Whether another manufacturer could avoid infringement by changing the color scheme would depend in a particular case on how important the color scheme was in the overall effect or impression of the design. Obviously if the design consisted merely of a simple red square or circle with dots, a change by the copier from red to green would be of great importance. On the other hand, if the design were an intricate or unusual one, as the court noted in Soptra, a mere change in color would be insufficient to avoid infringement.

Since I believe the applicable principles are clear and that nothing would be gained by further prolongation of this case, I would rule now that, except for the "Fleetwood Spice" and "Sand" designs, there was no infringement of Novelty's 253 and to that extent affirm the decision of the district court.

determining whether invention as whole would have been obvious under 35 U.S.C. 103; it looks not only to subject matter that is literally recited in claim in question but also to those properties of subject matter that are inherent in subject matter and are disclosed in specification, in delineating invention as whole; just as chemical and its properties are looked to when obviousness of composition of matter claim is examined for obviousness, invention as whole, not some part of it, must be obvious under Section 103.

2. Patentability — Invention — In general (§51.501)

Controlling question in determining obviousness is simply whether differences between prior art and invention as whole are such that invention as whole would have been obvious.

3. Patentability — Invention — In general (§51.501)

Standard of 35 U.S.C. 103 is not that it would be obvious for one of ordinary skill in art to try invention; disregard for unobviousness of results of "obvious to try" experiments disregards "invention as a whole" concept of Section 103, and overemphasis on routine nature of data gathering required to arrive at applicant's discovery, after its existence became expected, overlooks last sentence of Section 103.

4. Patentability — Change — In general (§51.251)

Patentability — Invention — In general (§51.501)

Exception to rule that discovery of optimum value of variable in known process is normally obvious occurs when parameter optimized was not recognized to be result effective variable.

Particular patents — Contactor Apparatus

Antonie, Rotating Biological Contactor Apparatus, rejection of claims 1-3 reversed.

Appeal from Patent and Trademark Office Board of Appeals.

Application for patent of Ronald L. Antonie, Serial No. 331,796, filed Feb. 12, 1973. From decision rejecting claims 1-3, applicant appeals. Reversed; Miller, Judge, concurring in result; Maletz, Judge, with whom Rich, Judge, joins, dissenting with opinion.

Court of Customs and Patent Appeals

In re Antonie

No. 76-681 Decided Aug. 18, 1977

PATENTS

1. Patentability — Invention — In general (§51.501)

Court of Customs and Patent Appeals must first delineate invention as whole in

Arthur H. Seidel, Thomas W. Ehrmann, and Quarles & Brady, all of Milwaukee, Wis., for appellant.

Joseph F. Nakamura (R. D. Edmonds, of counsel) for Commissioner of Patents and Trademarks.

Before Markey, Chief Judge, Rich, Baldwin, and Miller, Associate Judges, and Herbert N. Maletz,* Associate Judge, United States Customs Court.

Baldwin, Judge.

This is an appeal from a decision of the Patent and Trademark Office (PTO) Board of Appeals (board) affirming the rejection of claims 1, 2 and 3 of an application for "Rotating Biological Contactor Apparatus" as obvious under 35 USC 103 in view of El-Naggar.¹ We reverse.

The Invention

Appellant claims a wastewater treatment device in which wastewater is continuously passed through a tank. Semi-immersed contactors (disks) are continuously rotated to aerate their immersed portions and thereby to aerate both microorganisms that grow on the contactors and the wastewater itself. For this discussion, several variables are important in this device. "Throughput" is the volume of wastewater per unit time (gal./day) which the device must treat. "Contactor area" is the total area of the contactors which is exposed to the wastewater as the contactors are rotated (sq. ft.). "Tank volume" is the actual volume of liquid in the tanks in which the contactors rotate (gal.). The ratio of throughput to contactor area (gal./day/ sq. ft.) is called the "hydraulic loading." Two concepts of effectiveness of the equipment are important in this discussion. The primary prior art reference uses the term "efficiency" to denote the percent impurity reduction which a given set-up of the device achieves and we shall so use the term. Appellant uses the term "maximum treatment capacity" to denote when a unit of contactor area is providing maximum "efficiency" for a given "throughput" or maximum "throughput" for a given "efficiency." It is essential to understand the distinction

* Judge of the United States Customs Court sitting by designation pursuant to 28 U.S.C. 293(d).

¹ Serial No. 331,796, filed February 12, 1973. "Method of Treatment of Sewage by Bio-Oxidation and Apparatus Therefor," U.S. Patent No. 3,335,081, issued August 8, 1967.

between "efficiency," a matter of ultimate effectiveness independent of the efficiency of the equipment, and "treatment capacity," a matter of the efficiency or effectiveness of a unit of contactor area. The latter is more properly associated with the normal use of the term "efficiency" denoting maximum result from a limited resource.

Appellant's claimed device has a ratio of tank volume to contactor area of 0.12 gal./sq. ft.² Appellant maintains that this ratio is the most desirable or optimum for all set-ups of the device in the sense that using a lower value gives lower "treatment capacity" and using a greater value gives no increase in "treatment capacity," merely increasing costs. Thus, the value is optimum in that it maximizes "treatment capacity" so that the effectiveness of a given contactor is maximized.

The Prior Art

El-Naggar teaches the basic structure of the device claimed by appellant but is silent regarding quantitative design parameters other than to give data on a single example, which data was apparently complete *except for any discussion of "tank volume."* El-Naggar stated the "efficiency" (obviously referring to the purity of the output) could be increased to 95% by increasing the area of the contactor.

The Rejection

The examiner rejected the claims as obvious under 35 USC 103, noting that the basic device in question is old as taught by El-Naggar. While the ratio of tank volume to contactor area of 0.12 gal./sq. ft. is not disclosed in El-Naggar, the examiner reasoned that the disclosure of El-Naggar would make a device with that optimum value obvious. The examiner noted that El-Naggar suggests increasing the "efficiency" (degree of purification) of his device by increasing the contactor area while apparently keeping the "throughput" constant, that is, reducing the "hydraulic loading." The examiner then *assumed* that El-Naggar teaches keeping the tank volume constant while increasing the contactor area. Thus, the examiner argued that the idea of increasing tank volume to surface area to increase efficiency is taught and that working out the value for optimum efficiency is mere mechanical experimentation. The board accepted the examiner's reasoning.

² Claims 1 and 2 recite "at least about 0.12" while claim 3 recites "about 0.12."

Opinion

[1] In determining whether the invention as a whole would have been obvious under 35 USC 103, we must first delineate the invention as a whole. In delineating the invention as a whole, we look not only to the subject matter which is literally recited in the claim in question (the ratio value) but also to those properties of the subject matter which are inherent in the subject matter and are disclosed in the specification. In re Davies, 475 F.2d 667, 177 USPQ 381 (CCPA 1973). In this case, the invention as a whole is the ratio value of 0.12 and its inherent and disclosed property. That property is that the described devices designed with the ratio will maximize treatment capacity regardless of the values of the other variables in the devices. Just as we look to a chemical and its properties when we examine the obviousness of a composition of matter claim, it is this invention *as a whole*, and not some part of it, which must be obvious under 35 USC 103. Cf. In re Papesch, 50 CCPA 1276, 315 F.2d 381, 137 USPQ 43 (1963).

[2] The controlling question is simply whether the differences (namely the value of 0.12 and its property) between the prior art and appellant's invention as a whole are such that appellant's invention as a whole would have been obvious. The answer is no. It is impossible to recognize, from the experiment taught by El-Naggar, that "treatment capacity" is a function of "tank volume" or the tank volume-to-contactor area ratio. Recognition of this functionality is essential to the obviousness of conducting experiments to determine the value of the "tank volume" ratio which will maximize treatment capacity. Such functionality can only be determined from data representing either efficiency at varying tank volume, fixed throughput, and fixed contactor area or throughput at varying tank volume, fixed efficiency, and fixed contactor area. Each of these experiments represents treatment capacity with fixed contactor area but varying tank volume. This sort of experiment would not be suggested by the teachings of El-Naggar since he was not trying to maximize or control "treatment capacity." The experiments suggested by El-Naggar do not reveal the property which applicant has discovered, and the PTO has provided us with no other basis for the obviousness of the necessary experiments.

[3] The PTO and the minority appear to argue that it would always be *obvious* for one

of ordinary skill in the art to *try* varying *every* parameter of a system in order to optimize the effectiveness of the system even if there is no evidence in the record that the prior art recognized that particular parameter affected the result.⁴ As we have said many times, *obvious to try* is not the standard of 35 USC 103. In re Tomlinson, 53 CCPA 1421, 363 F.2d 928, 150 USPQ 623 (1966). Disregard for the unobviousness of the results of "obvious to try" experiments disregards the "invention as a whole" concept of §103, In re Dien, 54 CCPA 1027, 371 F.2d 886, 152 USPQ 550 (1967) and In re Wiggins, 55 CCPA 1356, 397 F.2d 356, 158 USPQ 199 (1968), and overemphasis on the routine nature of the data gathering required to arrive at appellant's discovery, after its existence became expected, overlooks the last sentence of §103. In re Saether, 492 F.2d 849, 181 USPQ 36 (CCPA 1974).

[4] In In re Aller, 42 CCPA 824, 220 F.2d 454, 105 USPQ 233 (1955), the court set out the rule that the discovery of an optimum value of a variable in a known process is normally obvious. We have found exceptions to this rule in cases where the results of optimizing a variable, which was known to be result effective, were unexpectedly good. In

⁴ The precise nature of the El-Naggar experiment and the nature of the data which would result are rendered hopelessly speculative by El-Naggar's total failure to discuss the critical matter of what is done with the volume of the tank. The PTO appears to assume, as a necessary element of its conclusion, that appellant's ratio is the inevitable result of El-Naggar experiment, and that the tank volume is fixed, apparently because El-Naggar does not suggest changing the tank as additional contactor area is supplied. Even if the same tank were used, the actual liquid volume of the tank could change significantly if 1) the tank has a level control, 2) the tank is not extremely large in comparison to the contactors and 3) the volume-to-area ratio of the contactors themselves is significant. Since these assumptions are not unreasonable, there is serious doubt as to the constant volume of the tank.

Whether one would inevitably arrive at the ratio value of 0.12 or above depends on facts which must be read into El-Naggar, (e.g., the volume of the tank) and on assumptions about the kind of motivation (e.g., the degree of "efficiency" which would be sought). All of this involves, at least on this record, mere speculation. Assuming, as the examiner has, that the tank volume is fixed and the natural motivation is to maximize efficiency, if El-Naggar's equipment has a tank volume to contactor area ratio of less than 0.12, and the resulting efficiency is found wanting, increasing the contactor area to increase "efficiency" will lead away from the claimed ratio.

re Waymouth, 499 F.2d 1273, 182 USPQ 290 (CCPA 1974); *In re Saether*, *supra*. This case, in which the parameter optimized was not recognized to be a result-effective variable, is another exception. The decision of the board is reversed.

Maletz, Judge, with whom Rich, Judge, joins, dissenting.

With all due respect, I cannot agree with the majority's interpretation of the El-Naggar patent. El-Naggar discloses the same wastewater treatment apparatus as claimed, except for the specific volume-to-surface ratio of .12 gallons per square foot as recited in the claims. However, El-Naggar generally discloses varying the number of disks (column 3, lines 31-35), the number of concentric cylinders (column 4, lines 27-30), or the length of the cylinders (column 4, lines 61-62) in his apparatus in order to optimize results. Given the basic apparatus of El-Naggar and the concept of varying the number of disks in a tank in order to optimize impurity removal, I believe that it would have been well within the capabilities of the chemical engineer of ordinary skill to determine empirically, by routine experimentation, the optimum design ratio which appellant has determined and recited in his claims. That is, El-Naggar set the way, and appellant's work was what any routineer would have accomplished in following the patent teachings.

Appellant urges that the results which he determined empirically by plotting the effect of volume-to-surface ratio on impurity removal, including the specific, optimum design ratio of .12 gallons per square foot, could not have been predicted from El-Naggar. However, obviousness under 35 USC 103 does not require absolute predictability, *In re Kronig*, 539 F.2d 1300, 190 USPQ 425 (CCPA 1976), and it is sufficient here that El-Naggar clearly led the way for the routineer to arrive at the claimed apparatus.

I am in substantial agreement with the board's analysis of this case, and I would affirm the board's decision.

Court of Customs and Patent Appeals

In re Flook

No. 77-512 Decided Aug 4, 1977

PATENTS

1. Patentability — Subject matter for patent monopoly — Mental processes (§51.609)

Patentability — Subject matter for patent monopoly — Process, product and apparatus (§51.613)

Claim to process that uses algorithm to modify conventional manufacturing system can be statutory subject matter; claims that include recitation of post-solution activity, step in which solution of algorithm is applied to control system, are not unpatentable under *In re Christensen*, 178 USPQ 35.

2. Patentability — Subject matter for patent monopoly — Mental processes (§51.609)

Patentability — Subject matter for patent monopoly — Process, product and apparatus (§51.613)

Claims involving mathematical formula that do not preempt formula or algorithm, in that solution of algorithm would not infringe claims, are not unpatentable.

Particular patents — Alarm Limits

Flook, Method for Updating Alarm Limits, rejection of claims 1-10 reversed.

Appeal from Patent and Trademark Office Board of Appeals.

Application for patent of Dale R. Flook, Serial No. 194,032, filed Oct. 29, 1971. From decision rejecting claims 1-10, applicant appeals. Reversed.

Frank J. Uxa, Thomas J. Clough, and John B. Goodman, all of Harvey, Ill., for appellant.

Joseph F. Nakamura (Thomas E. Lynch, of counsel) for Commissioner of Patents and Trademarks.

Before Markey, Chief Judge, and Rich, Baldwin, Lane, and Miller, Associate Judges.

Baldwin, Judge.

This is an appeal from a decision of the Patent and Trademark Office (PTO) Board

321 (1974). While the \$10,000 awarded plaintiffs in fees might be considered generous when compared with the amount recovered in damages, the fees do not appear unreasonable considering the amount of work necessitated and performed and the skill employed. See also *Key West Hand Print Fabrics*, 269 F.Supp. at 615-16, 155 USPQ at 132-133. There was no abuse here.

However, we deny plaintiffs' application for allowance of additional attorneys' fees on appeal. We assume counsel was familiar with the law, having made similar arguments in district court on all the issues raised on appeal. See *Monogram Models*, 492 F.2d at 1288, 181 USPQ at 429. The appeal was not frivolous. Plaintiffs did not prevail on their cross appeal. Equity considerations lead us to permit the parties to pay their own attorneys' fees in this court. The plaintiffs are entitled to costs.

Affirmed.

Court of Customs and Patent Appeals

In re Boesch and Slaney

No. 79-597

Decided Mar. 13, 1980

PATENTS

1. Patentability — Invention — In general (§51.501)

Patentability — Invention — Specific cases — In general (§51.5091)

Discovery of optimum value of result effective variable in known process is ordinarily within skill of art.

2. Patentability — Composition of matter (§51.30)

Patentability — Evidence of — In general (§51.451)

Patentability — Evidence of — Comparison with allowed claims or patents (§51.457)

Patentability — Invention — In general (§51.501)

Patentability — Invention — Specific cases — In general (§51.5091)

Prima facie case of obviousness may be rebutted where results of optimizing variable, which was known to be result effective, are unexpectedly good; proof of unexpected properties may be in form of direct or indirect comparative testing of claimed compounds and closest prior art.

3. Patentability — Composition of matter (§51.30)

Patentability — Evidence of — In general (§51.451)

Patentability — Evidence of — Comparison with allowed claims or patents (§51.457)

Patentability — Invention — Specific cases — Chemical (§51.5093)

Data that compares four examples of claimed alloys with one example of prior art alloy and is intended to show unexpected results are not commensurate in scope with claims for broad range of elements in case in which weight percent of elements in four examples of claimed alloys vary by relatively minor amounts, for example, entire claimed range of carbon is .18 percent, but tested range is only .02, and claimed cobalt range is 4.8, but test range is only 1.3, and there is no evidence showing whether other alloys encompassed by these broad claims and having elements varying by relatively major amounts also exhibit unexpected results.

4. Patentability — Composition of matter (§51.30)

Patentability — Evidence of — In general (§51.451)

Patentability — Evidence of — Comparison with allowed claims or patents (§51.457)

Patentability — Invention — Specific cases — Chemical (§51.5093)

Test results involving single alloy within broad range claimed are not sufficient to support appellants' allegation of what would, from prior art, be unexpected under circumstances in which essential concept of invention is to maintain average number of electron vacancies at value not exceeding about 2.35, prior art teaches that reduction of Nv value reduces the chances of sigma phase in alloy, appellants allege that alloys meeting their composition and Nv value requirements are free from sigma phase, and appellants tested only one example of low Nv value alloy and found no sigma, which is result consistent with both prior art

teaching and appellants' allegation that their claimed alloys are totally free from sigma phase; where it is alleged that certain technique for flipping coins would always produce "heads," one would hardly be persuaded by single toss of coin that resulted in showing of "heads."

Particular patents — Nickel Alloys

Boesch and Slaney, Temperature Nickel Based Alloy and Process of Making Same, rejection of claims 1 and 8-15 affirmed.

Appeal from Patent and Trademark Office Board of Appeals.

Application for patent of William J. Boesch and John S. Slaney, Serial No. 587,776, filed June 17, 1975. From decision rejecting claims 1 and 8-15, applicants appeal. Affirmed.

Robert F. Dropkin and Vincent G. Gioia, both of Pittsburgh, Pa., for appellants.

Joseph F. Nakamura (John W. Dewhirst, of counsel) for Commissioner of Patents and Trademarks.

Before Markey, Chief, Judge, Rich, Baldwin, and Miller, Associate, Judges, and Maletz,* Judge.

Miller, Judge.

This is an appeal from a decision of the Patent and Trademark Office ("PTO") Board of Appeals ("board") which sustained the examiner's rejection under 35 USC 103 of appellants' claims 1 and 8-15 in view of Lamb² and Pohlman³ et al. We affirm.

Invention

The invention embraces nickel base alloys consisting essentially of:

<u>Metals</u>	<u>Percentage Ranges</u>		
aluminum	4.0	-	4.7
boron	0.005	-	0.03
carbon	0.0	-	0.18
chromium	13.7	-	15.3
cobalt	14.2	-	19.0
iron	0.0	-	4.0
molybdenum	3.8	-	4.8
titanium	3.0	-	3.7

* The Honorable Herbert N. Maletz of the United States Customs Court, sitting by designation.

¹ Serial No. 587,776 was filed on June 17, 1975.

² U.S. patent No. 3,147,155, issued September 1, 1964.

³ U.S. patent No. 3,457,066, issued July 22, 1969.

The remainder of the alloys comprises nickel and incidental impurities. The elements in the alloys are balanced to provide an N_V value not in excess of about 2.35⁴ according to the following equation:

$$N_V = 4.66 (A\% Cr + A\% Mo) + 1.71 (A\% Co) + 0.61 (A\% Ni)$$

In the case of alloys within the board range set forth above, but not balanced to meet the required N_V value, room temperature ductility deteriorates, and creep⁵ deformation increases, after prolonged exposure at elevated temperatures. Appellants state that these results are attributable to formation of a deleterious phase (known as "sigma phase") in the metal after such exposure, and that the tendency of an alloy to form sigma phase is (unexpectedly) eliminated by balancing the relative amounts of its constituent elements in accordance with the N_V equation. Where the composition of an alloy has been controlled to provide an N_V value of about 2.35 or less, no sigma has been found after exposure at 1500°F for time periods up to 7200 hours.

Claim 1 is illustrative:

1. A nickel base alloy having a composition consisting essentially of up to 0.18% carbon from about 14.2% to about 19.0% cobalt, from about 13.7% to about 15.3% chromium, from about 3.8% to about 4.8% molybdenum, from about 3.0% to about 3.7% titanium, from about 4.0% to about 4.7% aluminum, up to about 4.0% iron, from 0.005% to about 0.03% boron and the balance essentially nickel with incidental impurities, the aforementioned elements being balanced to provide an N_V value not in excess of about 2.35 according to the following equation:

$$N_V = 4.66 (A\% Cr + A\% Mo) + 1.71 (A\% Co) + 0.61 (A\% Ni)$$

⁴ N_V refers to the average electron vacancy concentration per atom in the matrix of the alloy.

⁵ Appellants state that the overall variation in N_V due to chemical uncertainty is ± 0.25 so that in reality the N_V value of about 2.35 may actually extend from 2.32 to 2.38.

"Appellants' specification states that A% "refers to the atomic percent of the element so described."

⁵ Creep is the permanent deformation of a metal that occurs as a result of prolonged compression or extension at or near room temperature. The Condensed Chemical Dictionary 228 (8th ed. 1971).

the alloy being characterized by its freedom from precipitation of deleterious amounts of sigma-like phase after exposure at temperatures in excess of 1500°F for periods of time in excess of 1000 hours.

Prior Art

Lamb discloses a process for hot working age-hardenable nickel-chromium alloys. The alloys contain:

<u>Metals</u>	<u>Percent by Weight</u>		
aluminum	4.0	-	5.4
boron	0.003	-	0.1
chromium	14.0	-	16.0
carbon	0.01	-	0.2
cobalt	14.0	-	25.0
molybdenum	3.0	-	5.5
titanium	3.0	-	4.6
zirconium	0.01	-	0.2

A sample alloy is heated at 1190°C for 1.5 hours and cooled to 1000°C at about 1°C per minute, after which it may be hot worked at 1120°C. When hot working is complete, the alloy will generally require a further heat treatment to develop full creep resisting properties.

Pohlman et al. disclose nickel base alloys suitable for elevated temperature operation containing:

<u>Metals</u>	<u>Percent by Weight</u>		
aluminum	4.2	-	4.6
boron	0.025	-	0.035
carbon	0.04	-	0.07
chromium	14.5	-	15.5
cobalt	14.5	-	15.5
molybdenum	4.5	-	5.5
titanium	3.3	-	3.7

The remainder of the alloys essentially comprises nickel and incidental impurities; possibly, also, small amounts of silicon and manganese.

Both references are silent regarding an N_V value requirement, although Lamb requires "a total aluminum and titanium content from about 7.75% to about 9.5%," and Pohlman et al. "prefer about 14.5-15.5 percent by weight cobalt because that range results in the best balance at elevated temperatures between such properties as tensile and rupture strengths, oxidation resistance and the ability of the sheet material to be formed or worked."

The Boesch Affidavit

Seven heats of alloys (appellants' Table I below), which were within the claimed composition ranges but whose N_V values varied from 2.40 to 2.54 (all clearly above the upper limit of 2.35 set forth in the claims), were processed and heat treated. Appellants' Table II shows that all seven heats contained sigma phase.

TABLE I
CHEMISTRY-WEIGHT PERCENT

<u>Heat No.</u>	<u>C</u>	<u>Cr</u>	<u>Ni</u>	<u>Co</u>	<u>Fe</u>	<u>Mo</u>	<u>Ti</u>	<u>Al</u>	<u>B</u>	<u>N_V</u>
D1-379-1	0.01	15.3	Bal.	17.9	--	4.5	3.6	4.7	0.023	2.53
D1-379-2	0.04	15.3	Bal.	17.9	--	4.6	3.6	4.7	0.022	2.54
D1-380-1	0.06	15.3	Bal.	17.5	1.0	4.6	3.6	4.7	0.021	2.51
D1-380-2	0.06	15.1	Bal.	17.4	3.5	4.5	3.5	4.6	0.020	2.40
D1-382	0.06	15.3	Bal.	18.5	--	4.3	3.5	4.4	0.019	2.47
D1-383	0.06	15.2	Bal.	17.7	--	4.3	3.6	4.4	0.020	2.43
D1-386	0.06	15.3	Bal.	18.1	--	4.7	3.4	4.6	0.021	2.49

TABLE II

Heat No.	Approximate w/o Sigma
Dl-379-1	1.4
Dl-379-2	0.9
Dl-380-1	0.4
Dl-380-2	0.05
Dl-382	0.05
Dl-383	0.3
Dl-386	0.3

The affidavit states that "any amount of sigma phase is deleterious and undesirable because of the susceptibility to embrittlement failure following exposure to high temperature."

The Board

The board agreed with the examiner that the claimed alloys were *prima facie* obvious from the prior art, noting that there was no substantial disagreement that both Pohlman et al. and Lamb disclose alloys having compositional limits overlapping those of the claimed alloys. Although disagreeing with the examiner's contention that there was no evidence to support the statement in the Boesch affidavit that "any amount of sigma phase is deleterious and undesirable," it agreed with the examiner that the Boesch affidavit was insufficient to overcome the *prima facie* case of obviousness because there was no evidence showing:

(1) the precise amounts of sigma-like phase present in compositions containing Appellants' claimed components balanced to provide N_v values just inside versus just outside Appellants' claimed "about 2.35" N_v limits; and (2) direct comparisons of sufficient mechanical properties of those compositions within and without the claimed limit, to demonstrate the alleged critical correlation of N_v limit with sigma phase content.

* The board agreed with the examiner that "there [was no evidence showing] that an alloy

The board also said that the showing (in the specification, set forth *infra*) did not establish the asserted criticality in selection of the components of the alloys according to the claimed N_v formula, because the alloys failed to meet the claimed compositional and N_v value requirements.

Opinion

The Prima Facie Case

Each of the ranges of constituents in appellants' claimed alloys overlaps ranges disclosed by Pohlman et al. and Lamb. Appellants, citing *In re Waymouth*, 499 F.2d 1273, 182 USPQ 290 (CCPA 1974), argue that neither of the cited prior art references recognizes the problem solved by them and, therefore, cannot render the claims obvious. Upon examination of the prior art references, we do not agree. Appellants admitted in their specification that:

It has been postulated according to Pauling's theory that the criterion for the formation of sigma phase is based upon the number of electron vacancies (N_v) in the bonding orbitals of the elements involved. Based thereon, other investigators have derived an empirical equation which includes the elements chromium, molybdenum, manganese, iron, cobalt and nickel. It is to be noted, however, that the nickel base alloys to which reference is made in the present invention relate to an iron-free or low-iron composition, with only incidental amounts of an element such as manganese, and are hardened by the aluminum and titanium rich intermetallic compound gamma prime.

U.S. patent No. 3,837,838 ('838), filed December 18, 1972, and issued September 24, 1974, was introduced into evidence by appellants and further illuminates what is meant by "Pauling's theory":

As described in an article by Linus Pauling entitled "The nature of interatomic forces in metals," published in *Physical Review*, 54:899, 1938, in a given metallic atom, the outer most orbitals, termed the bonding orbitals, are occupied by the bonding electrons responsible for bonding the atom to its neighboring metallic atoms. At a given instant in time and on the average, the bonding orbitals

having an N_v number of 2.35 is free of any amount of sigma phase, or what the sigma phase content and properties are of an alloy having an N_v number of 2.36 which is close to but outside the N_v requirement."

are only partially occupied by the bonding electrons. Such partial occupation means that the outer orbitals are partially vacant of electrons or possess an "electron hole." The total average number of vacant orbitals in a given metallic atom is called the electron hole number of the metal (N_v). The average electron hole number (N_v) is the resultant of adding all N_v for the participating elements in the alloy matrix. The higher the N_v of a given Co-Cr-Ni alloy the higher the chance for the precipitation of embrittling phases. The quantities of metals consumed in precipitation do not enter in calculating N_v of the alloy matrix and hence do not participate in the formation of embrittling phases. A low N_v may thus be obtained by either choosing elements of low N_v to form an alloy or by using elements that will react in the alloy and precipitate out from the alloy matrix.

Accordingly, in carrying out this invention, I have selected an alloy-base for the system which possesses a low N_v , and have strengthened the alloy base by adding elements which will have minor or no effect on raising the N_v through controlling their percentage as solutes or by eliminating their effect on N_v by formation of compounds which precipitate out.

It appears from appellants' specification that certain precipitate-hardened nickel base alloys, after being exposed to elevated temperatures for prolonged periods of time, suffered "from a marked and catastrophic decrease in room temperature ductility and a marked increase in the rate of creep deformation." It was observed that other nickel base alloys having the same percentage ranges of components did not suffer such deleterious changes. The cause of the problem was believed to be the formation of an embrittling phase ("sigma"). As early as 1938, however, it was known that the higher the N_v value of a Co-Cr-Ni alloy, the higher the chance for precipitation of embrittling phases; also, that the quantities of metals consumed in precipitation did not enter into

calculating the N_v value of an alloy matrix. We are persuaded that one of ordinary skill in the art would have been guided by these principles.

[1] In the above-quoted passage from '838, we note that lowering the N_v value of a Co-Cr-Ni alloy and deletion of the metals not consumed in precipitation from the N_v calculation are expressly suggested. Considering, also, that the composition requirements of the claims and the cited references overlap, we agree with the Solicitor that the prior art would have suggested "the kind of experimentation necessary to achieve the claimed composition, including the proportional balancing described by appellants' N_v equation." This accords with the rule that discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art. In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977); In re Aller, 42 CCPA 824, 220 F.2d 454, 105 USPQ 233 (1955). Accordingly, we conclude that a *prima facie* case of obviousness has been established.

Unexpected Results

[2] It is well settled that a *prima facie* case of obviousness may be rebutted "where the results of optimizing a variable, which was known to be result effective, [are] unexpectedly good." In re Antonie, *supra*, 559 F.2d at 620, 195 USPQ at 8-9, and cases cited therein. It is also well settled that proof of unexpected properties may be in the form of direct or indirect comparative testing of the claimed compounds (here, alloys) and the closest prior art. In re Payne, 606 F.2d 303, 316, 203 USPQ 245, 256, (CCPA 1979), and cases cited therein.

A. Creep Tests

Table V, set forth in appellants' specification and shown below, compares four examples of the claimed alloys with one example (6-3211) of a prior art alloy and is intended to show that the measured creep of the claimed alloys is unexpectedly less than that of the prior art.

TABLE V
Creep Tests at 1500°F and 37,000 psi

Alloy No.	Sample Removed After (Hours)	Measured Creep (inches per inch)
2-1422	1567.8	0.008
2-1423	1500.4	0.004
2-1425	1504.5	0.010
2-1426	1500.4	0.004
6-3211	1505.1	0.034

The measured creep of 6-3211 — an alloy, appellants note, having "chemistries" within those of the references — is in excess of three to eight times greater than the creep of the claimed alloys.

The composition and N_v values of the alloy heats in Table V are as follows:

Alloy No.	Element, Weight %							N_v Value
	C	Al	Ti	Mo	Cr	Co	B	
2-1422	0.07	4.20	3.23	4.70	14.7	18.0	0.030	bal. 2.32
2-1423	0.06	4.37	3.45	4.45	14.6	17.6	0.028	bal. 2.36
2-1425	0.06	3.91	2.98	4.40	14.8	17.5	0.028	bal. 2.21
2-1426	0.05	4.20	3.19	4.50	14.5	17.5	0.030	bal. 2.27
6-3211	0.06	4.43	3.54	4.95	15.2	18.8	0.030	bal. 2.51

Although it is apparent that the molybdenum content of 6-3211 exceeds the maximum content of the claimed alloys by 0.15%, it is clearly within the ranges of the Pohlman et al. and Lamb alloys.

[3] However, we are not persuaded that the Table V data are commensurate in

scope with appellants' claims. In re Greenfield, 571 F.2d 1185, 1189, 197 USPQ 227, 230, (CCPA 1978).⁹ Appellants claim broad ranges of elements, but the weight percent of elements in the four examples of the claimed alloys vary by relatively minor amounts. For example, the entire *claimed* range of carbon is .18 percent, but the *tested* range is only .02 (.07 minus .05); the claimed cobalt range is 4.8, but the test range is only 1.3. There is no evidence showing whether other alloys encompassed by appellants' broad claims and having elements varying by relatively major amounts also exhibit a low creep rate.

B. Ductility Test

Appellants' Table VI, set forth in their specification, compares the room temperature ductility of one heat of the claimed alloy (2-1426) and one heat of an alloy (6-3266) which appellants state has "chemistries" within those of the references.

TABLE VI
Room Temperature Tensile Tests

Alloy No.	Condition	U.T.S. psi	0.2%			
			Offset Y.S. (psi)	Elong. (%)	R.A. (%)	N_v Value
2-1426	As-heat-treated	204,000	140,000	16.9	15.0	2.27
2-1426	As-heat-treated + exposed 5000 hrs. at 1500°F	157,000	100,000	16.1	14.1	2.27
6-3266	As-heat-treated	194,500	136,800	14.0	13.7	2.52
6-3266	As-heat-treated + exposed 5000 hrs. at 1500°F	150,500	117,500	5.0	5.5	2.52

The marked decrease in room temperature ductility (Elong.) after prolonged elevated temperature exposure of the prior art alloy (6-3266), compared to the claimed alloy's (2-1426) essentially unchanged ductility, is contended to show an unexpected result, as was the improvement in measured creep discussed earlier. However, for the same reason that the measured creep test data of Table V are not persuasive of unexpected results, we do not regard the tensile test data of Table VI, comparing only one heat of a claimed alloy, sufficient to rebut the *prima facie* case of obviousness of the claimed invention.

C. Absence of Sigma Phase

Throughout prosecution appellants have maintained that the claims define "a nickel

base alloy which can be manufactured in a consistent way to remain free from a tendency to form plate-like sigma phase." The "essential concept of the present invention [is] to maintain the average number of electron vacancies at a value not exceeding about 2.35." Whereas the Pauling theory teaches that a low N_v value means *reduced chances* for sigma phase, appellants allege that alloys meeting their composition and N_v value requirements are *free* from sigma phase.

[4] As related earlier, the Boesch affidavit shows that sigma phase is present in

⁹ It is unnecessary to decide whether 6-3211 is the "best prior art." See In re Malagari, 499 F.2d 1297, 1302-03, 182 USPQ 549, 552-53 (CCPA 1974).

seven alloy examples, all of which meet the composition requirements but exceed the N_V value requirement of the claimed alloys. However, this affidavit contains no examples of claimed alloys showing the absence, or presence, of sigma. The remainder of the record reveals only a single example of the claimed alloy, which shows the absence of sigma.¹¹ Appellants' specification includes a photomicrograph of Table V alloy heat 2-1422, which clearly shows the absence of sigma; also, a photomicrograph of Table V alloy heat 6-3211, which shows the presence of sigma. We note again that the prior art teaches that reduction of the N_V value *reduces the chances of* sigma phase in the alloy. Here appellants tested only one example of a low N_V value alloy and found no sigma — a result consistent with both the prior art teaching and appellants' allegation that their claimed alloys are "totally free from sigma phase."¹¹ Under such circumstances, test results involving a single alloy within the broad range claimed are not sufficient to support appellants' allegation of what would, from the prior art, be unexpected.¹²

In view of the foregoing we hold that appellants have failed to rebut the *prima facie* case of obviousness.

The decision of the board is *affirmed*.

Affirmed.

¹¹ Thus, appellants have again failed to show test data commensurate in scope with the broad claims.

¹² We agree with the board that the six United States patents ((1) No. 4,093,474, issued June 6, 1978; (2) No. 4,083,734, issued April 11, 1978; (3) No. 3,930,904, issued January 6, 1976; (4) No. 3,837,838, issued September 24, 1974; (5) No. 3,816,110, issued June 11, 1974; and (6) No. 3,767,385, issued October 23, 1973) introduced into the record by appellants "do support the assertion in the Boesch affidavit that 'any amount of sigma phase' is undesirable." Therefore, we have limited our analysis to the issue of the existence of sigma phase and have not extended it to include the effect of varying amounts of sigma phase.

¹³ Where it is alleged that a certain technique for flipping coins would always produce "heads," one would hardly be persuaded by a single toss of a coin which resulted in a showing of "heads."

Court of Customs and Patent Appeals

In re Breslow

No. 79-602

Decided Feb. 28, 1980

PATENTS

1. Patent grant — In general (§50.01)

Patent grant — Nature of patent rights — In general (§50.201)

Government grants only right to exclude; there is no other agreement; analogy of a patent to a contract on theory that it is issued in exchange for invention's disclosure, "consideration," is inexact; patent is statutory right; it is granted to "Whoever" fulfills conditions, Section 101, unless fraud has been committed.

2. Court of Customs and Patent Appeals — Issues determined — Ex parte patent cases (§28.203)

Question of whether claimed compounds "are even formed" on which point Board of Appeals disagreed with examiner who argued that there was no indication nor proof on this point and board expressly held to contrary is not before Court of Customs and Patent Appeals.

3. Patentability — Subject matter for patent monopoly — In general (§51.601)

Ex parte Howard, 328 O.G. 251, 1924 C.D. 75, dealt with construction of "manufacture" rather than "composition of matter," with gob, of at least obvious, molten glass in transitory state rather than with novel chemical compounds, and with mechanical molding process in which it was well known to use molten gob of glass as distinguished from novel chemical process using entirely new and unobvious group of chemical compounds.

4. Patentability — New use or function — Composition of matter (§51.555)

Patentability — Subject matter for patent monopoly — In general (§51.601)

In re Stubbs, 13 USPQ 358, did not deal with issue of whether claimed compounds are excluded from category of "composition of matter" in Section 101 merely because they are transitory, unstable, and non-isolatable.

5. Patentability — New use or function — Composition of matter (§51.555)